are the most closely related forms. Between *punctatus* and *macarellus* is a sharp break.

An explanation of the distribution of the forms is that *affinis* spread from the Indian Ocean westward around the world. The form differentiated in the Atlantic was *rhonchus* and in the Pacific *maru-adsi,* species whose range has since been restricted to Africa and Japan and China, but still the westward migration continued, *maru-adsi* migrated into the Indian where it became *kurra,* separated by intermediate stages from the *affinis,* which had been there since the beginning and still pushing westward became *punctatus* in the Atlantic and *macarellus* in the Pacific.

With this theory as a view-point the thing that immediately calls for explanation is the relation to one another of the two final forms *punctatus* and *macarellus,* and of their ranges. The forms are so strongly differentiated as to presuppose long separation by a barrier as of land, yet they are the only adjoining members of the series occurring in the same waters, as they do in the Atlantic. A land connection from Africa to South America would obviate this difficulty as the two forms would at once have invaded one another's Atlantic ranges when this barrier was removed. Also we must explain the peculiar range of *macarellus,* found in Atlantic and Pacific, but not in the Indian, which may be readily done by supposing that the North and South American land connection is of recent origin.

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AMERICAN MUSEUM OF NATURAL HISTORY

THE AMERICAN CHEMICAL SOCIETY

The Effect of the Club Root Disease upon the Ash Constituent of the Cabbage Root: HOWARD S. REED.

The ash analysis of healthy and diseased cabbage roots reveals appreciable variations in the amounts of certain constituents while others vary but slightly. In the diseased roots there was an appreciable increase in the amounts of calcium, magnesium, phosphoric acid, potassium and sulphuric acid, *i. e.,* an increase in the amount of "essential" elements.

The greatest increase of any single constituent was in the case of potassium. The increase of potassium appears to be coupled with an increase of protoplasmic substance and accumulation of starch.

The proportion of calcium to magnesium is greater in the diseased roots. The same is also true of the proportion of potassium to sodium, but there is no material difference in the proportion of magnesium to phosphorus. The differences in the amounts and proportion of ash constituents appear sufficiently well marked to indicate a more or less definite correlation in the metabolism both of healthy and of diseased plants.

Effect of Frost on the Aromatic Constituents of the Peppermint Plant: FRANK RABAK.

The Volatile Leaf-oil of the Washington Cedar, Thuja plicata: ROBERT E. ROSE and CARL LIVINGSTONE.

Absorption and Excretion of Salts by Roots, as Influenced by Concentration and Composition of Culture Solutions: I., Concentration Relations of Dilute Solutions of Calcium and Magnesium Nitrates to Pea Roots: R. H. TRUE and H. H. BARTLETT.

Creatinine in Plants and in the Medium in which they Grow: M. X. SULLIVAN.

The Effect of Temperature on the Respiration of Fruits: H. C. GORE.

The Phosphorus Assimilation of Aspergillus niger: ARTHUR W. DOX.

(From the Chemical Section of the Iowa Agricultural Experiment Station.)

The necessity for some form of phosphorus in culture media for lower fungi has long been recognized. Notwithstanding the variety of phosphorus compounds occurring in nature, very few have been tested with regard to their availability as sources of this element for mold cultures. Among the substances tested in this experiment were phytin, sodium glycerinophosphate, sodium nucleinate, lecithin, casein, ovovitellin, ortho-, pyro- and metaphosphates, hypophosphites and phosphites. All but the last two, which contain trivalent phosphorus, were readily utilized.

Fermentation and Putrefaction: ARTHUR I. KENDALL.

(From the Department of Preventive Medicine and Hygiene, Harvard Medical School.)

As shown by the work of the author and others, utilizable carbohydrates protect nitrogen from attack by bacteria. This finds its analogue in the metabolism of higher forms. Fermentation takes precedence over putrefaction. For the purposes of this paper, by fermentation is meant the

action of bacteria upon carbohydrates; while by putrefaction is meant the action of bacteria upon nitrogenous substances. The two phenomena, fermentation and putrefaction, are antagonistic processes: the obligate putrefactive bacteria can not, as a rule, grow in media in which active fermentation is going on, because the acids produced inhibit their development. There is a third group, the facultative organisms, which are able to adapt themselves to both kinds of food. This is an important new conception. Thus in the presence of dextrose the diphtheria bacillus elaborates no toxin, while in its absence large amounts are formed. *B. coli* behaves similarly. Not only do the products vary, but the composition of the bacteria themselves may be altered. All these considerations will prove of great importance in practise.

The Carbon Nitrogen Ratio in the Decay of Protein Compounds: JACOB G. LIPMAN.

Biochemical and Toxicological Studies upon Penicillium: C. L. ALSBERG and O. F. BLACK.

A Study of the Optical Forms of Lactic Acids produced by Pure Cultures of B. bulgaricus: JAMES N. CORRY.

Nucleic Acid in Soils: EDMUND C. SHOREY.

Conditions for Tannic Acid Fermentation: LEWIS KNUDSON.

As a result of the fermentation of tannic acid (gallotannic), gallic acid is formed. Van Tieghem first showed that the fermentation of this substance may be effected by the two organisms *Aspergillus niger* and *Penicillium glaucum*. Pottevin and Fernbach simultaneously reported the extraction of the enzyme tannase, the transforming agent. Since that time several other investigators have contributed to the subject.

Experiments made by the writer indicate that if tannic acid alone is offered as a source of carbon, the gallic acid formed as a result of the tannic acid transformation is utilized in the metabolism of the organism—the greater the growth of the fungus, the greater is the decrease in tannic acid. It is likewise shown that the duration of growth, the presence of other nutrients and aeration—factors influencing growth mass—were important considerations with respect to the yield of gallic acid.

An infusion of gall nuts contains, in addition to tannic acid and gallic acids, other organic compounds as well as inorganic salts. When cultures are made in which the gall nut infusion is used as the nutrient solution, the tannic acid is transformed; but the gallic acid is not at first utilized. The organism seems to elect the other organic compounds first and then some of the gallic is utilized. There is then an election of food by the organism.

If there is offered to *Aspergillus niger* or *Penicillium* sp. in a nutrient salt solution, 10 per cent. cane sugar along with 13 per cent. tannic acid, then the sugar entirely protects the gallic acid formed from assimilation, or use as food by the fungus. A 5 per cent. concentration of sugar is not sufficient to protect the gallic acid, during the growth interval employed.

Experiments were also made in which the fermentation cultures were kept under anaerobic, and also limited oxygen conditions, and the results obtained were compared with those in which growth was permitted under more favorable conditions of aeration and nutrition.

Regulatory Formation of the Enzyme Tannase: LEWIS KNUDSON.

The work of Fermi, Pfeffer, Katz, Went, Dox and others has shown that to a considerable extent the formation of enzymes is influenced markedly by the nutrition of the organism. According to Dox, the production of those enzymes that are not normally developed by the organism in demonstrable quantities can not be induced by any special nutrition. This statement is not in accord with the results obtained by Went; nor with the more recent work of Harden and Norris working with yeast, wherein it is shown that there may be induced by special nutrition an enzyme which normally did not occur in the yeast plant. The work of the writer, herewith briefly reported, is also in disagreement with the results of Dox.

The two organisms, *Aspergillus niger* and *Penicillium* sp., which normally develop on commercial gall nuts when these are moistened and exposed to the air, produce the enzyme tannase; and this enzyme is capable of effecting the transformation of tannic acid into gallic acid and glucose.

Pottevin found that the enzyme tannase was formed in *Aspergillus niger* when it was grown in Raulin's solution in which the sugar was replaced by tannic or gallic acid. The writer has grown the organism in synthetic solutions in which the carbon nutrient, cane sugar, was replaced entirely or supplemented by one of several carbon compounds. In the experiments the effect of each of fourteen different carbon compounds was tested, but the enzyme tannase was produced only when the sugar was replaced by tannic or gallic acid,

or supplemented by tannic acid. The gallic acid, furthermore, was not as efficient as the tannic acid in stimulating the formation of the enzyme.

Some work has been done showing that the quantity of a particular enzyme produced irrespective of the character of the carbon nutrient, can be increased in amount by offering the organism the carbon compound which is transformed by the enzyme in question. No work apparently has been reported on the effect of concentration of the transformable substance on the quantity of the corresponding enzyme produced. Employing the two organisms mentioned, the writer made experiments, in which a modified Czapek's solution was the nutrient medium—in this the concentration of sugar was made 10 per cent., and it was supplemented by tannic acid in concentrations varying from 0.01 per cent. to 10 per cent. The quantity of the enzyme produced was augmented by increase in concentration of the tannic acid. None, however, was formed when the concentration of tannic acid was as low as 0.01 per cent.

Similar results were obtained with *Penicillium* sp. *Aspergillus candidus, Aspergillus oryzæ* and *Penicillium granulatum* cultivated in a synthetic solution in which the carbon was supplied as 5 per cent. cane sugar and supplemented by 2 per cent. tannic acid also developed the enzyme tannase. *Penicillium expansum* in a similar solution did not develop the enzyme.

The enzyme tannase would fall then in the third class, as described by Went, which class includes only those enzymes which are produced when a particular carbon compound is present in the nutrient solution.

The Synthesis of Fats by the Action of Enzymes: F. L. DUNLAP and L. O. GILBERT.

Five grams oil-free castor bean, 5 g. flaxseed, 25.5 g. glycerol, 16.7 g. Kahlbaum's oleic acid were triturated in a mortar till emulsified. The flaxseed was introduced to perfect the emulsion. It is without action. This emulsion was allowed to stand and its acidity titrated at intervals. After eleven days the loss of acidity was such as to correspond to a disappearance of over 26 per cent. of the total oleic acid present, so that the enzyme of ricinus has undoubted synthetic power.

On the Measurement of the Oxidase Content of Plant Juices: H. H. BUNZEL.

The Pigmentation of the Adult Periodical Cicada, with a Note on Chemical Anti-oxidases: ROSS AIKEN GORTNER, the Carnegie Institution of Washington.

The black pigment of the periodical cicada (*Tibicen septendecim* L.) is shown to be produced by the interaction of a chromogen and an oxidase of the tyrosinase group. Coloration proceeds after death but does not produce the normal uniform coloration, since, apparently, the tyrosinase is secreted together with the new cuticula, and after death this secretion ceases.

In the note on chemical anti-oxidases the suggestion is made that, perhaps, dominant whites are due to the presence of aromatic compounds carrying two hydroxyl groups in meta position to each other. It was noted that tyrosin did not produce the typical coloration in the presence of tyrosinase when orcin, resorcin or phloroglucin—all meta-dihydroxyl benzol derivatives—were present in the solution. This result was, apparently, caused by the tyrosinase being affected in the same manner as though an anti-oxidase were present, for proof was given that the tyrosin had not united chemically with the m-di-hydroxyl compound, and data were also given which makes it appear very improbable that the cause lies in a more rapid oxidation of the orcin, etc., to colorless derivatives. The only other alternative is that the action is of the same nature as that of a true anti-oxidase. If, therefore, through some body process, an additional hydroxyl were added to tyrosin adjacent to the alkyl chain, a compound would result which should not give colors with tyrosinase, nor allow colors to be produced even though tyrosin were present. Such a situation would produce dominant whites.

A Study of the Methan Fermentation in the First Stomach of Ruminants: SLEETER BULL.

Crude fiber, or cellulose and starch, undergo a fermentation in the paunch of ruminants with the formation of methane carbon dioxide, acetic acid, butyric acid and isobutyric acid.

By the artificial fermentation of cellulose it was found that 1.0 gm. of cellulose produced .033–.040 gm. of methane.

Omeliansky found that one gram of cellulose produced .068 gm. of methane, .3057 gm. of acetic acid and .2038 gm. of butyric and isobutyric acid.

Knowing the energy value of the cellulose—4.220 cals.—and that of the products of the fermentation, it may be computed that 1.4048 cals. of energy are liberated as "heat of fermentation" in the fermentation of one gram of cellulose. Expressed in terms of methane, 1.1549 cals. of energy are lost as "heat of fermentation," for every calory of methane excreted by the animal.

Applying this factor to results of experiments upon steers with the respiration calorimeter at the Institute of Animal Nutrition of the Pennsylvania State College, in which the amount of methane excreted and the amount of heat emitted after the ingestion of a known amount of food were determined, it is found that in the case of a hay ration 32 per cent. of the "heat of digestion" arose from the methane fermentation of the carbohydrates.

Effects of the Quantity of Protein Ingested on the Nutrition of Animals: II., On the Weight of some of the Vital Organs of Lambs: W. D. CARROLL and A. D. EMMETT.

Effects of the Quantity of Protein Ingested on the Nutrition of Animals: III., On the Ash and Total Phosphorus of Flesh from Lambs: R. H. WILLIAMS and A. D. EMMETT.

Effects of the Quantity of Protein Ingested on the Nutrition of Animals: IV., On the Creatin of Flesh from Swine and Lambs: W. E. JOSEPH and A. D. EMMETT.

A Cage Designed for Metabolism Experiments on Goats: A. R. ROSE.

In this station it was found most practical, when using the cow, in metabolism experiments, to keep men constantly on the watch to collect the excreta. This method is exceedingly laborious, and a smaller animal which could be caged easily was sought as a substitute for the unwieldy cow. For this purpose the goat serves admirably, and it is rather remarkable that an animal with so many qualifications for metabolism work has received so little attention. The goat is of convenient size to be readily handled, and it takes rations and yields excreta of very satisfactory bulk and might very well represent the herbivora in animal experimentation. It becomes quickly at home in the cage and adjusted to the demands of the investigator.

The cage consists essentially of an elevated wooden box, with gratings in the upper part, to admit light and air. Inside wooden walls are covered by galvanized sheet iron. One side is attached only at the top by means of hinges, and forms a door to admit or remove the goat, and for convenience in milking.

The floor is a heavy wire screen with wires sufficiently far apart to let all waste pass through, yet allowing five wires for each foot to rest upon.

Under the screen, at the front end, is a pan to collect any food dropped in eating. Under the rest of the floor is the device for separating the excreta from one another, consisting of two galvanized sheet iron parts, the hopper and urine pan. This hopper terminates in a trough leading toward the front end of the cage. This trough has at the point of junction with the hopper, an opening in its bottom protected by strands of wire, by which the dung pellets coming down the hopper are deflected into a suitable removable receptacle standing on the floor under the front end of the cage. The urine passes through this hole into a shallow pan suspended from the hopper trough, immediately beneath. This pan has an elongated spout leading forward through which the urine flows into another receptacle standing on the floor beside the one provided for the dung.

The cage is simple in construction. It was made by local carpenters with the aid of a tinsmith, at a cost of thirty-seven dollars. The complete cage occupies a floor space of about two by four feet, is seven feet high and can be easily carried by two men. The cage is equally applicable to studies on sheep.

On the Lipins of the Heart Muscle of the Ox: JACOB ROSENBLOOM.

(From the Laboratory of Biological Chemistry of Columbia University, at the College of Physicians and Surgeons, New York.)

MacLean[1] has found that the essential fat of the liver has the properties of phospholipin. He thinks it probable that the fatty matter from certain other organs is of the same nature. He finds by extraction of the liver with ether and alcohol, at room temperature, that 84 per cent. of the total extract is phospholipin in quality, whereas, if the extraction is carried out at the temperature of the *boiling* solvent, only about 40 per cent. of the extract partakes of the properties of phospholipin. MacLean believes that such treatment with the *boiling* solvent causes a cleavage of the tissue phospholipin, with a consequent increase in the amount of neutral fat in the extract.

In a study of the lipins of the heart muscle of the ox, practically identical percentages of neutral fat and phospholipin were found by the writer in the ether and alcohol extracts which had been obtained by treatment with the respective solvents at room temperature and also at their *boiling* temperatures. It is possible, however, that the ether and alcohol extracts of the liver contain substances of a lipin nature which are more easily

[1] MacLean, *Biochemical Journal*, 1909, IV., p. 455.

decomposed than those in similar extracts of heart muscle.

The Effect of Pregnancy on the Lipins of the Ovary and Corpus Luteum of the Cow: JACOB ROSENBLOOM.

(From the Laboratory of Biological Chemistry of Columbia University, at the College of Physicians and Surgeons, New York.)

A comparative study of the amounts of neutral fat, fatty acid, lecithan and cholesterol, in ether and alcohol extracts of the ovary and corpus luteum of the cow, showed that pregnancy had no effect on the respective proportions in which these substances appeared in the extracts.

Relation of Permeability to the Fertilization of the Ovum: E. P. LYON and SHACKELL.

Demethylization under Normal and Pathological Conditions: I., Chronic Alcoholism: WM. SALANT and I. K. PHELPS.

Elimination of Caffein in the Urine: WM. SALANT and J. B. RIEGER.

The Effect of Diet on Resistance to Drugs: WM. SALANT.

The Stability of the Photogenic Material of the Lampyridæ and its Probable Chemical Nature: F. ALEX MCDERMOTT.

The photogenic compound present in the Lampyridæ is much more stable towards atmospheric oxygen than has usually been thought, especially when dried out of contact with air; it presents many points of similarity to other known biologic products; from embryologic and chemical considerations it appears probable that it is a lipoid or lecithin.

Gases of Swiss Cheese: WILLIAM M. CLARK.

The Brine Soluble Compound found in Cheese: L. L. VAN SLYKE and ALFRED W. BOSWORTH.

(Chemical Laboratory, New York Agricultural Experiment Station, Geneva, N. Y.)

Investigations which have been conducted in this laboratory during the past years have shown that during the ripening of cheddar cheese a form of protein is always produced which is soluble in a 5 per cent. sodium chloride solution. The presence of this brine-soluble compound was shown to be connected in some way with the development of acid in the cheese. The compound was at first erroneously supposed to be paracasein-monolactate and later free paracasein. In recent work it was noticed that calcium was always to be found associated with this brine-soluble compound when it was separated from the other cheese constituents by extraction with solution of c.p. sodium chloride (free from calcium), after first removing the water-soluble constituents.

This brine-soluble compound is always present in cheddar cheese. In a cheese two years old 40 per cent. of the nitrogen was present in this form. It is also a fact that in cheddar cheese all of the calcium is never extracted with water, part of it always being found in the brine extract. In camembert cheese, however, the reverse is found. After the first few hours this cheese contains no brine-soluble compound and all the calcium is found in the water extract. The brine-soluble compound is formed in this cheese, but, owing to the method of making, more acid is allowed to develop than in cheddar cheese and, as a consequence, the brine-soluble compound loses its calcium and thereby becomes free paracasein, which is insoluble in brine solution.

We believe that, according to the evidence in hand, the following equation represents the reaction which takes place where the compound in question is taken into solution by a salt solution:

$$\text{Calcium caseinate} + 2\ \text{NaCl} \rightleftarrows \text{Sodium caseinate} + \text{CaCl}_2.$$

We believe that the mass action, thus represented, is also connected with the precipitation produced upon adding calcium chloride to the brine-soluble compound after its solution has been freed from excess of chlorides by dialysis.

The Influence of Sodium Chloride on the Precipitability of Casein by Acetic Acid, and its bearing on the Partition of Nitrogen in Butter: WM. N. BERG.

The Estimation of Creatin: STANLEY R. BENEDICT.

Twenty c.c. of urine (or a volume equal to twice the amount which will be required for an accurate creatinine reading) is treated with 20 c.c. of approximately normal hydrochloric acid and the mixture boiled nearly to dryness in a beaker or open flask. After the mixture has almost reached dryness it is placed in a boiling water-bath, and allowed to remain there for about five minutes after the residue is approximately dry. With the aid of warm water the residue is then washed into a fifty c.c. volumetric flask, the mixture cooled and five c.c. of 8–10 per cent. basic lead acetate solution added, and the mixture diluted to exactly fifty c.c., and mixed by shaking. The mixture is filtered through a dry filter into a dry beaker and twenty-five c.c. of the filtrate used for the colorimetric determination as in Folin's process, save that six c.c. 10 per cent. alkali are

employed, which should best contain also five per cent. of rochelle salt. This process has the great advantage that in the conversion of the creatin less pigment is produced than in former methods.

The Determination of Calcium in the Presence of Phosphates and Magnesium: F. H. MCCRUDDEN.

Methods of Estimating Moisture in Tissues: WALDEMAR KOCH.

With valuable biological material it is sometimes desirable to make water estimations and the estimations of the other constituents on the same sample. As there is danger of decomposing the constituents by the high temperature employed for drying in the official method, comparisons of this method with the one devised some years ago[2] and used in this laboratory were made and are recorded in the following table:

	W. 8 Direct with Alcohol	W. 21 Dried by Heat at 95° C.
Proteins	48.5	47.5
Phosphatids	21.6	16.3
Cerebrosides	8.8	9.4[3]
Sulphatids	3.6	4.3[3]
Undetermined lipoids	8.2	11.0[4]
Organic and inorganic extractives	9.3	11.6
	100.0	100.1
Lip P in per cent. of total	62.5	53.6

The Preparation of Tissue for Toxicological Examination: JAMES P. ATKINSON.

The finely minced tissue is digested with artificial gastric juice. The solution is filtered and extracted for alkaloids in the usual way. After this extraction the material is evaporated with nitric acid and then examined for metallic poisons. This method has three advantages: (1) The examination may be completed within three days, (2) less personal attention is required, (3) the tissue is completely broken down and therefore allows a better extraction of the alkaloids than by extracting the minced tissue with acid alcohol.

Studies of Water Absorption by Colloids: WILLIAM J. GIES.

On the Diffusibility of Biological Substances through Rubber: WILLIAM J. GIES.

[2] W. Koch, *The Journal of the American Chemical Society*, Vol. XXXI., p. 1335.

[3] Variation due to difference of age.

[4] Increase due to fatty acids from destruction of phosphatids.

The Aging of Flour and its Effect on Digestion: J. A. WESENER and GEO. L. TELLER.

The Occurrence of Lipase in the Fat of the Common Fowl (Gallus domesticus): M. E. PENNINGTON and J. S. HEPBURN.

If a chicken be kept hard frozen or at the temperature of the room, or at any temperature between these two extremes, the acidity of the fat increases, as has been shown in previous publications of this laboratory. Since the fat-splitting enzyme, lipase, is found in many plant and animal tissues, this investigation was undertaken to determine if lipase be present in the crude fat of chickens. The technique is fairly simple. The crude abdominal fat is passed several times through a meat chopper; and its acidity is determined. A weighed sample of the ground fat is triturated in a mortar with sand, and then extracted with ten times its weight of water. Fifty c.c. of the aqueous extract and 1 c.c. of an ester (ethyl acetate, butyrate or benzoate, or amyl salicylate) are mixed, the solution is made neutral to phenolphthalein and incubated at 40° C. for periods of time varying between 24 and 168 hours—usually 72 hours. Toluol is used as a bactericide. Fifty c.c. samples of the aqueous extract are boiled, then run as blank experiments in exactly the same manner as were the determinations proper. At the end of the incubation both determinations and blank experiments are titrated; the increase in acidity of the determination proper over the blank is due to the action of lipase.

This research has demonstrated the presence of lipase in the crude abdominal fat of fresh chickens retaining the animal heat, and of chickens kept at temperatures from that of the room to that of the "freezer" for varying periods of time. The highest acidity of the crude fat, and the greatest activity of the lipase, occurred in chickens which had been kept hard frozen for sixteen months, or which had been permitted to putrefy at room temperature. The lowest acidity of the crude fat and the least activity of the lipase were found in a fresh chicken still retaining the animal heat. Apparently in fresh birds the enzyme is present as a zymogen, which is converted into the active form as the chicken ages after death.

Deterioration in Eggs as shown by Changes in the Moisture Content: A. D. GREENLEE.

Eggs contain a high percentage of moisture when fresh—white about 88 per cent. and yolk about 48 per cent. This percentage of moisture is constantly changing, due both to a loss to the

external atmosphere by evaporation and also to internal rearrangement. The yolk absorbs water from the white. This change increases with the temperature and time, and when carefully measured it becomes a good index of the condition and probable age of the egg. By test experiments on a uniform lot of eggs, held at a constant temperature and analyzed at short intervals of time, the rate of change of moisture content can be determined and plotted and by means of the subsequent formula derived, the condition of any lot of eggs can be predicted from the first analysis for any given date within the holding period.

By a further extension of the work now in progress it is hoped that the age and past history of the egg can be deciphered from a determination of the percentage and relative distribution of the moisture.

The Oxidation of Chicken Fat with Hydrogen Peroxide: J. S. HEPBURN.

When light, air, heat and enzymes act on fats and oils, the various constants undergo changes; and an increase in saponification number is usually accompanied by a decrease in Hehner number, and *vice versa*. This phenomenon is due chiefly to the oxidation of the unsaturated acids at the double bonds. However, when chickens are kept hard frozen, both the saponification number and the Hehner number experience simultaneous change in the same direction. Thus nine analyses give a mean saponification number 172.9 and a mean Hehner number 81.27 for fresh roasters, while three analyses of undrawn roasters, kept hard frozen for 16 months, give a mean saponification number 194.9 and a mean Hehner number 91.67; the two constants have increased at the same time. This species of fat decomposition must be due to oxidation of the carbon chain at or near the terminal carbon atoms. The recent work of Dakin upon the oxidation of saturated fatty acids by means of hydrogen peroxide, led to the present research.

Fat was extracted from chickens and analyzed. The extracted fat was heated on the water-bath for seven hours with three per cent. solution of hydrogen peroxide—six molecules of peroxide were used for each molecule of fat; the fat was then separated from the aqueous layer, washed free from peroxide with boiling water, filtered through paper and analyzed. The acidity always became higher; the iodine number usually decreased, though it occasionally increased. The saponification number and the Hehner number almost invariably increased simultaneously, hence dilute hydrogen peroxide at the temperature of the water-bath produces in chicken fat the same change as occurs in that fat *in situ* while hard frozen.

When oleic acid and stearic acid were oxidized in this manner, their saponification number decreased. This change is similar to that undergone by the fat of chickens kept hard frozen for periods of four months, at the end of which time both the saponification number and the Hehner number are lower than in the fat of fresh birds.

Detection and Rôle played by Polyatomic Phenols occurring in Apples as Glucosides: H. P. BASSETT.

In apples there is a glucoside resembling phloridzin. There is present also an enzyme which hydrolyzes it, liberating a polyatomic phenole. From the phenole by the action of an oxidizing enzyme a phlobaphene is formed. This oxidase reaction renders the fluid germicidal. It is suggested that this has a protective value for the fruit.

Observations on the Deterioration of Maize and Improvements in the Methods of Detecting it: O. F. BLACK and C. L. ALSBERG.

An Incubator for Moderate Temperatures: A. M. BUSWELL and RALPH H. MCKEE.

The incubator uses, without the aid of a relay, a 110-volt alternating current for the heating and the regulation of the current. The expanding liquid of the regulator is alcohol, the capillary U-tube outlet being filled with mercury. Five wires are sealed into the capillary tube and the resistances attached so that the voltage drop, as the mercury passes a sealed-in wire, will be but twenty volts. This is below the arcing voltage and consequently no carbonization occurs and practically no gas is formed by the make and break. The lights used for heating are in series with the mercury and such resistances as are pushed in by the expanding alcohol. Without attention the incubator kept between 36.5° and 37.5° for two months.

The Absorption of Inorganic Salts by Living Protoplasm: W. J. V. OSTERHOUT.

Carbohydrate Esters of the Higher Fatty Acids: WALTER R. BLOOR.

Esters of mannitol with stearic acid were prepared and their properties described. One of them was fed to animals. It was found that about 50 per cent. was absorbed.

(*To be continued*)